A NEW GENUS AND SPECIES OF SUDAN LEECH FORMERLY CONFUSED WITH *LIMNATIS NILOTICA* (HIRUDINIDAE S.L.: HIRUDINEA)

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SYNOPSIS

A new genus is based on a leech from Zalingei Swamp, Sudan. It has 3 pairs of narrow broken lines on the dorsum, somitally repetitive supramarginal maculations, and a marginal light stripe; but there are 16 complete 5-annulate somites, the posterior sucker is of moderate size, ejaculatory bulbs are present, and there are linear somital sense organs on the dorsal aspect of the posterior somites. A closely similar leech is recorded also from the Nile, near Fashoda.

INTRODUCTION

Leeches with salivary gland papillae on the jaws have been found in all regions, essentially between 35° North and South. Of these, only leeches in the Mexican genus *Limnobdella* Blanchard 1893, the Australian genus *Quantenobdella* Richardson 1969, and the present leech have 16 complete 5-annulate somites, all others (Soos, 1969) have 15 such somites, including the leeches in the Ethiopian genus *Limnatis* Moquin-Tandon 1826 based on *L. nilotica* (Savigny 1822). The genus *Limnobdella* (v. Richardson, 1969 : 106, '*Potamobdella*') has a macrobdelloid pharynx with some muscular ridges ending independently between the jaws on the entrance to the pharynx, multiple small testes in each somite, the epididymis formed on both limbs of a simple primary loop on the anterior region of the male paired ducts, no ejaculatory bulbs, the median regions bimyomeric and the female median region with an acaecate vagina and vaginal duct. The genus *Quantenobdella* described as lacking salivary gland papillae and having an hirudoid pharynx, is now found to have minute papillae and the pharynx smooth internally. *Quantenobdella* has simple saccular testes; the anterior region of the male paired duct lacks a loop and the epididymis is entirely posterior to the ejaculatory bulb, the two being linear in relationship; the median regions are bimyomeric and the female median region has a caecate vagina and a vaginal duct.

In the present leech, the pharynx is hirudoid; the testes are simple, saccular; the anterior region of the male paired duct forms a simple primary loop with the epididymis on the initial limb and an ejaculatory bulb on the terminal limb in a subparallel relationship; the median regions of the reproductive systems are as in *Limnobdella*.

These differences warrant the provision of a separate and new genus for the leeches from the Sudan. It has been shown (Richardson, 1969) that the content of the former family Hirudinidae based on the genus *Hirudo* was unacceptably heterogenous. Although separate families were provided then for Australian, Nearctic

and Neotropical genera, the provision of a family for Oriental and Ethiopian leeches having an acaecate vagina, as in the present leech, must be postponed until the aquatic jawed sanguivores of these regions are more adequately known. For the time being, the new genus can be referred to the Hirudinidae s.l.

Moore (1939) identified leeches in single collections from the American Museum of Natural History, the United States National Museum, and the British Museum (Natural History), all as being *Limnatis nilotica*. He briefly referred to them as resembling this species in having the annulation in no way differing from published accounts and with small papillae, large caudal suckers, the morphology of the crop caeca and of the reproductive systems as in Moquin-Tandon (1846, pl. vi, *Haemopis sanguisuga*) and Dequal (1912). The characteristics as taken from these authors are: a small anterior pair and a larger posterior pair of caeca on each compartment of the crop; the epididymis formed on both limbs of a simple primary loop on the anterior region of the male paired duct which lacks ejaculatory bulbs; the two ejaculatory ducts enter independently into the atrium (Moore, 1939, Fig. 58) and the vagina acaecate with a vaginal duct of the same length as the vagina. The vaginal duct is shown as short by Dequal (1912, Fig. 13) and the vagina possibly caecate; but there is definitely no duct according to Moquin-Tandon (1846, pl. vi, Figs 15, 17). Moore recorded from the specimens before him, the presence of only 45 to 60 teeth, a pattern of 3 pairs of continuous or broken dark dorsal 'lines', yellow marginal stripes and the venter immaculate as in 'typical North African' examples of this species.

Moore's material in the British Museum (Natural History) was collected in 1925 and came from Zalingei Swamp, former British Sudan. Specimens from this collection and another from the Nile near Fashoda, 1907, were loaned to Keegan *et al.* (1969) who figure without other description a leech from one of these collections, under the name of *Limnatis nilotica*. (The external features, Figs 7 A & B, 8 A & B; the jaw, Figs 8 C & D, and reproductive system, Fig. 8 E.)

The reproductive system as shown in Keegan *et al.* differs from the illustration in Moore (1939, Fig. 58) of the system in a specimen in the U.S. National Museum collection No. 5501, from between Abyssinia and British East Africa, in that Keegan *et al.* show small ejaculatory bulbs embracing the epididymi and the two ejaculatory ducts joining to form a distinct common duct leading to the atrium. No such common duct has been known in jawed sanguivorous or macrophagous leeches, the two ducts always entering the atrium independently.

Re-examination of specimens from the 1925 Zalingei Swamp and 1907 Fashoda collections confirm the basic pattern as described by Moore and shown in Keegan *et al.* The jaws carry minute teeth and papillae. Three dissected leeches show anterior and posterior paired caeca on the crop compartments but differ from Keegan *et al.* in having the ejaculatory ducts entering independently into the atrium, as in Moore (1939). They further agree with Moore in having a single primary loop on the anterior region of the male paired duct but differ by having the epididymis on the initial limb of the loop subparallel to the bulb on the terminal limb, as in Keegan *et al.* They differ again from Moore in having linear somital sense organs on the dorsum of the posterior part of the body, as in most species of *Limnatis* (i.e. excepting *paluda* and possibly *nilotica*).

In having 16 complete 5-annulate somites, the specimens differ from the genus *Limnatis* as defined by Moore (1927) and Soos (1969). As I have shown previously, if we attempt to follow Moore (1927 et seq.) and admit such a difference into a single genus, the generic entity fails on other grounds (Richardson, 1969, 1970). There is no established genus suitable for them. Accordingly I provide a new genus as below.

DESCRIPTION

Aliolimnatis gen. nov.

Hirudinidae s.l. with a monostichodont condition; 16 complete 5-annulate somites (*ix* to *xxiv*); *xxv*, 4-annulate; somital sense organs, large and obvious on the dorsum, circular anteriorly, mostly linear and oblique posteriorly; jaws, moderate in size; teeth, minute, about 80; salivary gland papillae on the jaws; dorsal salivary glands, compact, a single mass without obvious columns of aggregated ducts; radial muscles, a distinct extrinsic system in *viii* and *ix*; pharynx and associated structures, hirudoid; mouth and lumen of pharynx, narrow, the lumen tubular; pharynx with six internal muscular ridges as dorsomedian and ventrolateral pairs, each pair joining to enter a jaw, none ending independently between the jaws; pharynx terminating posteriorly in *ix*; crop compartments in *x* to *xviii* each with an anterior small and posterior larger pairs of caeca, the posterior pair in *xix* forming the postcaeca extending to *xxvi*; intestine, simple tubular, joining terminally to the rectum; genital pores in *xi* and *xii* b_5/b_6; testes, normally 10 pairs; anterior region of male paired duct folded as a simple primary vertical loop, the epididymis on the initial limb posterior to the ejaculatory bulb on the terminal limb, the relationship subparallel; median regions, bimyomeric, mesomorphic; penis sheath reflected anteriorly; oviducts, short, of the length of the ovaries; atrium, thick-walled, large; common oviduct, thick-walled, longer than the oviducts, continuous with the acaecate vagina; vaginal duct, short.

Size, (?) medium. Pattern, longitudinal interrupted narrow dark bands, marginal contrast stripes.

Aquatic. Sanguivorous. Ethiopian Region.

The name *Aliolimnatis* is derived from *alius* another, and *limnatis* of the marshes. The gender is feminine.

TYPE SPECIES: *Aliolimnatis diversa* sp. nov.

Aliolimnatis diversa sp. nov.

Fig. 1 A–F

HOLOTYPE: B.M.(N.H.) Reg. No. 1970 3 1

SCHIZOHOLOTYPE: B.M.(N.H.) Reg. No. 1970.3.2 right ventrolateral jaw (microslide).

PARATYPES: B.M.(N.H.) 1970.3.3 (18·0 mm long). 1970.3.4.

LOCALITY: Zalingei Swamp, Sudan. (Coll. Admiral Lynes.)

General form. *Holotype* (Fig. 1, E.) preserved in alcohol, rather strongly contracted with the annuli generally at least as high as long; short, heavy-bodied, depressed, the dorsum almost flat, the margins obtusely rounded, the venter flat, and the depth nearly uniform along the length of the body.

The anterior sucker broad, the aperture transverse; the velum proper contracted, thick margined and turned ventrally; the body widening gradually behind the sucker, at first subcircular in section, then widening more rapidly to the anterior end of the clitellum and from here to the post-nephridial region, the width uniform, the margins parallel, converging abruptly in the post-nephridial region to form the narrow base to the sucker. The posterior sucker is about half the maximum width of the body.

Total length, 22·0 mm; depth generally 3·0 mm; width at *iv/v*, 2·4 mm, at *vi/vii* 4·0, at *ix/x* 4·8; clitellum and testicular region, 6·0 mm wide; basis for sucker, 2·0 and diameter of sucker 3·0 mm.

Colour and pattern. (Fig. 1, A, B, C, E.) Preserved, faded; general background colour, faintly yellowish brown on the dorsum, paler on the immaculate venter which is separated by a pair of dark longitudinal bands from distinct pale cream marginal stripes. A dark patch across the posterior quarter of the dorsum of the sucker which is otherwise pale above and below.

Three pairs of weakly indicated maculated interrupted dark longitudinal lines form narrow bands on the dorsum, dividing it into a median stripe, a wide inner and two narrow outer pairs of longitudinal stripes, all of the background colour so that the dorsum is not brilliantly or colourfully striped, and the marginal stripes provide the only contrast colour other than the dark bands. The maculations which form the dark bands have the appearance of very large individual chromatophores.

The ocular arch is on the edge of the background colour, with the 5th pair of eyes in from this edge which becomes lateral to the supramarginal line in *viii* and immediately lateral to the line of marginal somital sense organs along the greater length of the body including *xxvi*, so defining above the cream marginal stripe continuous around the velum and back to *xxvi/xxvii*.

The inner and middle pairs of dark bands extend along the medial and lateral borders of the paramedian fields; the inner pair commencing in *viii* and extending to *xxvi* a_2, define the median light stripe between these limits as filling the median field and including the paramedian sense organs. Between the ocular arch and *viii*, the median field and much of the interocular area are vaguely darker than the general colour elsewhere. The middle pair of narrow bands extend from in *vii* into *xxvi* (possibly also into *xxvii* for the dark patch on the sucker is divided as though into topographic equivalents of the inner and middle pair of bands). Between the inner and middle paired bands, the inner paired light stripe fills the greater part of the paramedian field, increasing in width as this field widens along the length of the body. The outer paired narrow dark bands are lateral in the intermediate field, extend from in *viii* back into *xxv* and between these limits define the middle paired stripes which include the intermediate sense organs and the greater part of the intermediate field.

The narrow outer paired stripes are lateral to the outer paired bands, defined laterally by the marginal stripe, and include the supramarginal sense organs, the supramarginal field and marginal sense organs along the greater length of the body.

In the middle half of the body, there are distinct small darker patches close to the lateral edge of the outer paired stripe. Each patch is restricted to an annulus. These occur with recognizable regularity on b_1 and b_5, in some somites on b_2 and b_5 and in a few somites on b_1 on only one side or the other. Such patches are present from *viii* to *xxvi*. The patches are spaced, nowhere give the appearance of a band, and form a distinct subsidiary pattern as in *Hirudinaria* and *Poecilobdella*.

The dark band separating the marginal stripe from the venter, extends along the line of the submarginal sense organs and briefly into the fields on either side.

Annulation. (Fig. 1, A, B, C.) Preserved, contracted. Intersomital and interannular furrows, very deep, equivalent; no obvious division of annuli into couplets or triplets; somital limits not indicated generally; annuli liberally divided by fine longitudinal lines into small rectangles. Somital sense organs are circular and difficult to detect on the venter, but obvious in large clear patches on the dorsum where all are circular in the anterior region but progressing posteriorly: the intermediates are elongate, linear and oblique to the long axis of the body; the supramarginals are linear along the long axis; then the paramedians are linear and oblique; and the supramarginals, linear and transverse. Linear somital sense organs occur back into *xxvi*; all are circular in *xxvii*. Sensillae are obvious with a central sensilla surrounded by others forming a rosette, the rosettes arranged as a row across the annulus, each rosette situated in a rectangle. Nephropores are obvious, minute, and situated close to the posterior border of a_1 and b_2 just laterally to the line of the intermediate sense organs.

The velum proper is broad with a thick incised margin. The velum includes the 1st to 3rd pairs of eyes; the first furrow *iv/v* does not reach the margin and the dorsolateral lobe of the margin of the sucker is not strongly defined anteriorly; *v*, 2-annulate above, a_1a_2 with the first eyes and first detectable paramedians $> a_3$, the furrow a_1a_2/a_3 reaching into the supramarginal fields with a_1a_2 briefly forming the lateral margin of the sucker which is completed by uniannulate *v* which also forms the ventral margin; *vi* is 3-annulate above, the 5th pair of eyes in a_2, $a_1 < a_2 > a_3$, a_1/a_2 ending in the supramarginal field and *vi* is 2-annulate below with $a_1a_2 > a_3$; *vii*, 3-annulate above and below, $a_1 < a_2 < a_3$; *viii*, 4-annulate with a_1 (=*vii* a_3) $> a_2 > b_5 = b_6$ and with the first pair of nephropores on a_1; *ix* to *xxiv* are all 5-annulate (total 16); *ix*, $b_1 = b_2 = a_2 < b_5 = b_6$; *x*, $b_1 = b_2 < a_2 = b_5 > b_6$, as also *xi*; due to contraction, the relative lengths of annuli are not assessable with confidence in *xii* to *xvii*; *xviii*, $b_1 = b_2 < a_2 < b_5 > b_6$, as also *xx* and *xxi*, so that b_5 may possibly be the longest annulus in typical 5-annulate somites of the middle nephric group; *xxiv*, $b_1 = b_2 < a_2 > b_5 = b_6$, and the last nephropores on b_2; *xxv*, 4-annulate above and below, $b_1 = b_2 < a_2 < a_3$; *xxvi*, 3-annulate above, $a_1 < a_2 > a_3$ but definitely 4-annulate below, a_1 being divided into $b_1 < b_2$ by a well-formed furrow which does not quite reach the margins of the body and is not to be seen from above; *xxvi* a_3 is the last annulus across the venter and is much

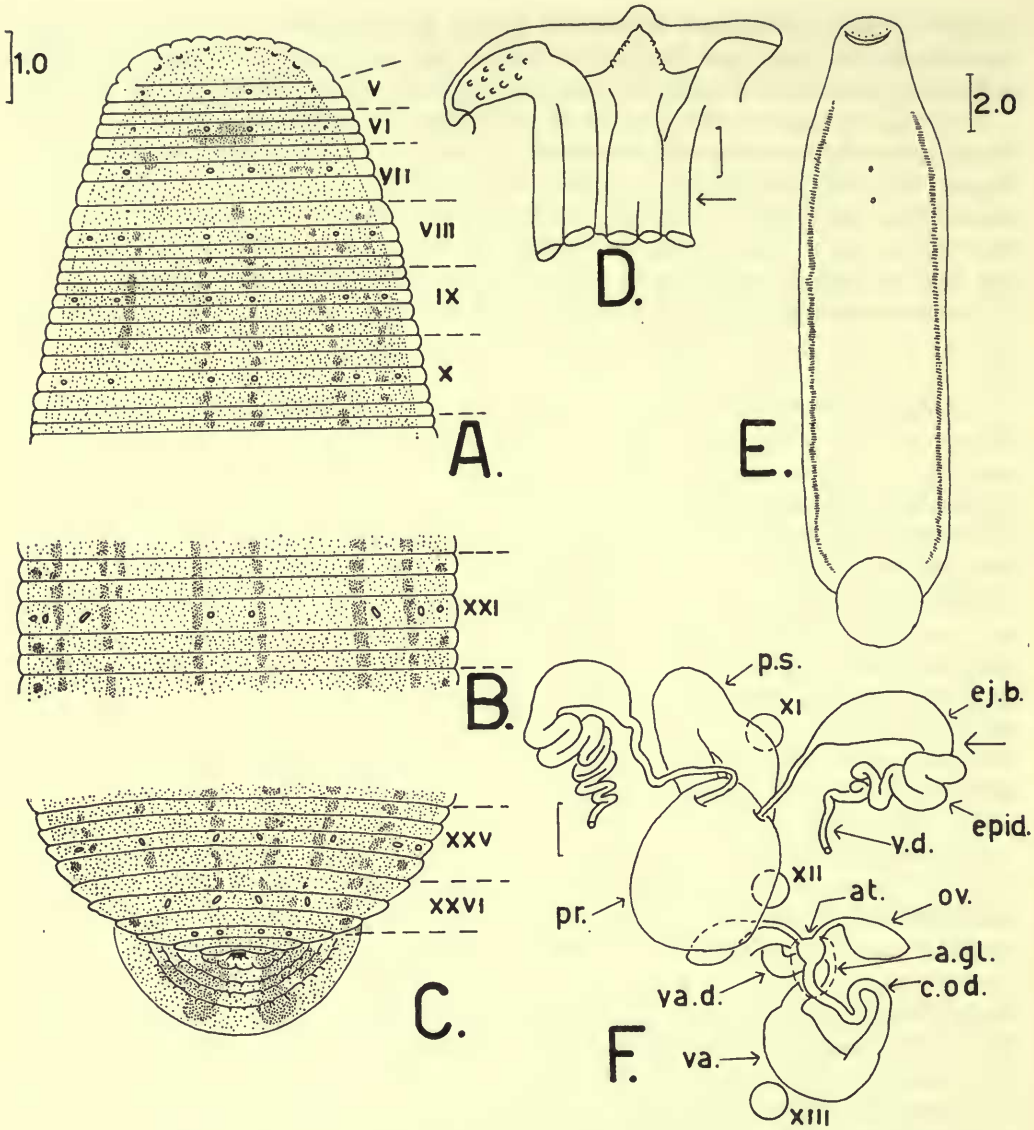

FIG. 1. *Aliolimnatis diversa* gen. et sp. nov. Dorsal annulation and pattern A. somites *i* to *x*, B. midnephric region, and C. somites *xxv* to *xxvii* and posterior sucker. D. Jaws, and internal muscular ridges of the pharynx opened along the midventral line (arrow marks mid-length of pharynx). E. Ventral aspect showing general form and submarginal bands. F. Anterior region of male paired ducts, male median region, and female reproductive system (arrow marks dorsal aspect of male primary loop). All figures from the type. Roman numerals indicate somites and somital ganglia. Somital ganglia represented at relative size. *A. gl.* albumin gland; *at.* atrium; *c. od.* common oviduct; *ej. b.* ejaculatory bulb; *epid.* epididymis; *ov.* ovary; *p.s.* penis sheath; *pr.* prostate; *va.* vagina; *va. d.* vaginal duct; *v.d.* vas deferens. Scales in mm, 0·5 mm unless otherwise indicated.

shortened; *xxvii*, incomplete 2-annulate with a brief accessory annulus. The anus is at the posterior border of *xxvii*.

Dorsum of the posterior sucker with 6 concentric furrows; some linear sense organs are detectable. The ventral face has some 20 primary muscle bands centrally, dividing to give in the order of 50 at the margin.

Alimentary tract. (Fig. 1, D.) The jaws are monostichodont, compressed, the dorsomedially wider than high at the median end with the base 0·6 mm wide, and the jaw 0·4 mm high; the dental margin is so low convex as to appear almost straight and is 0·9 mm long. There are about 79 teeth on the right ventrolateral jaw. The teeth are narrowly spaced, minute, about 0·018 mm tall at the median end, diminishing very gradually along the row so that teeth in the middle of the row are still 0·015 mm tall. The dorsomedian jaw is housed in an open groove, the ventrolaterals in open pits and the margins of all are so poorly defined that the pits and groove appear non-morphological. The salivary gland papillae are in three rows, small excepting the basal row which has some larger papillae. The dorsal salivary glands form a compact mass in *vii* to *ix* with no indications of columns of aggregated ducts. The extrinsic radial musculature of the pharynx is sparse but forms an obvious system in *viii* and *ix*. The pharynx commences at *vi/vii*. The entrance to the pharynx is narrow, barely wider than the base of the dorsomedian jaw, and the lumen is more simply tubular than tapering. The pharynx has a thin muscular wall with six internal muscular ridges arranged as dorsomedian and ventrolateral pairs, each pair fusing before entering the base of the corresponding jaw, none ending independently on the margin of the entrance to the pharynx. The pharynx terminates in the posterior portion of *ix* followed by a short simple compartment in *ix* as the first portion of the crop which has a short small compartment in *x* with an anterior small and posterior larger pairs of lateral caeca, as also on *xi* to *xviii* in which the compartments increase progressively in length and breadth, the anterior caeca remaining simple, small, and the posterior caeca increasing relatively in size, extending into the paramedian chamber and posteriorly to lie laterally to the anterior caeca of the following somite. In *xix*, the anterior caeca are small and restricted to the median chamber, the posterior pair form elongate postcaeca reflected in the paramedian chamber, reaching to *xxvi* and subdivided laterally into lobes. A short length of the crop completes the compartment in *xix*, connecting terminally at *xix/xx* to the simple tubular intestine which tapers to *xxiv/xxv* where it enters terminally into the short simple rectum.

Reproductive system. (Fig. 1, F.) The genital pores are at *xi* and *xii* b_5/b_6. The testes are simple saccular. There are normally 11 pairs situated intersomitally at *xiii/xiv* to *xxiii/xxiv*. The vasa deferentia extend in the paramedian chambers to the level of *xi/xii* with the anterior region of each male paired duct folded vertically in a simple primary loop in *xi*. The small epididymis is tortuous on the initial posterior limb of the loop with the muscular ejaculatory bulb on the anterior terminal limb, and the relationship of the organs is sub-parallel. The ejaculatory bulbs are subfusiform. Muscular ejaculatory ducts extend medially into the median chamber to enter independently into the dorsal aspect of the male

atrium, not the ventral aspect as is usual, because the male median region is formed on an anteriorly directed primary loop reflecting at *x/xi* so that the atrium is at the posterior end of the procurrent limb continuous with the muscular penis sheath which has the procurrent limb dorsal to the terminal recurrent limb.

The ovaries are elongate and tapering. The short oviducts join just behind ganglion *xii* to form an unusually large thick-walled atrium lined with a longitudinally rugose epithelium. The atrium tapers into the thick-walled common oviduct which is slightly tortuous and continues into the acaecate vagina. The vagina is sharply differentiated from the strongly muscular short thick-walled vaginal duct.

The prostate is a very large thick cap covering the atrium and extending briefly along the procurrent limb of the penis sheath. The albumin glands are a thick investment of the atrium and of most of the common oviduct.

Morphology of the Paratypes and other material. Four specimens ranging from 16·0 to 25·0 mm in length. The general form is as in the holotype. The diameter of the posterior sucker is slightly wider than half of the maximum body width, av. 56% (range, 50% to 65%) and most doubtfully of the width of the body excepting in extreme extension of the animal. Colour, as the holotype. Pattern, as the holotype in three specimens with the paired dark bands more pronounced, and all are distinctly maculate, nowhere continuous. The fourth specimen (25·0 mm) has only scattered sparse spaced maculations which do not conform to the topography of the paired bands in the others. Dorsal somital sense organs are distinctly linear on the posterior region of the first three specimens, but very vaguely indicated on the fourth (25·0 mm). Annulation, as in the holotype, excepting in the fourth specimen (25·0 mm) in which *ii/iii* and *iii/iv* cross the paramedian and median fields. In all, there are 16 complete 5-annulate somites, and *xxvi* is 3-annulate above and 4-annulate below.

The differences indicate a possible second species represented by the 25·0 mm specimen.

Two specimens from the Nile, near Fashoda. Material from the second collection available to me from the British Museum (Natural History) included two specimens. Data on the label are: *Limnatis nilotica* Savigny. 1907.11.12 1/3. Loc: Nile near Fashoda. Pres: Loat Collection.

The specimens are 39·0 and 49·0 mm long. Preserved, faded, general colour much as in *A. diversa* but slightly darker. Essential pattern as in *A. diversa*, excepting the paramedian field is moderately filled with many dark brownish bold maculations which are erratically placed and blend into the medial and lateral paired bands of this field. This gives the appearance of a broad band across the paramedian field and accentuates the median stripe so making it a prominent feature of the dorsum. This is much as shown in Keegan *et al.* (1969, Fig. 7).

Somital sense organs obscure, but some linear oblique organs are detectable posteriorly on the dorsum; sensillae, arranged as a rosette.

Annulation, as in *A. diversa*, with *ix* to *xxiv* complete 5-annulate (total 16) excepting that *xxiv* a_2 is incomplete briefly in the ventral median field, *xxvi* is simply

3-annulate above and below with the annuli crossing the venter as thin cutaneous folds, and *xxvii*, 2-annulate without an accessory annulus.

Alimentary tract as in *A. diversa*, excepting the intestine joins subterminally to the rectum so that there is a distinct rectal appendix about 2½ times as long as wide. The jaws were not studied for the dentition.

Reproductive system, 39·0 mm specimen. General morphology and morphological relationships as in *A. diversa*, the male median region reflecting at ganglion *x*; excepting that the anterior region of the male paired duct forms a posteriorly directed loop from *xi* into *xii*, on which the epididymis is on the recurrent limb and ventral to the bulb on the procurrent limb, the relationship is subparallel.

Annulation and pattern suggest another possible separate species in *Aliolimnatis*, a question to be decided only from the study of more and preferably better material.

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